

PATENT SPECIFICATION

743,856



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COMPLETE SPECIFICATION.

Improvements in Helicopters.

We, HUNTING PERCIVAL AIRCRAFT LIMITED (formerly known as Percival Aircraft Limited), a British Company, of Luton Airport, Bedfordshire, and LESLIE GEORGE 5 FRISE, a British Subject, of the Company's address, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described 10 in and by the following statement:—

The invention relates to helicopters of the kind which are both supported and propelled by rotating wings. In such machines a limitation in the forward speed is reached 15 at the onset of compressibility effects at the tips of the blades as they advance and of tip stall of the blades as they retreat. Reduction in the rate of rotation of the rotor reduces the limitation until the variation in lift of 20 the advancing and retreating blades causes excessive flapping with resultant vibratory and other troubles. The provision of fixed wings on such aircraft which have the effect of reducing the load on the rotor in forward 25 flight is effective in reducing these objectionable conditions and enabling still higher forward speeds to be obtained.

The flow of air through the rotor of such machines during forward flight follows a 30 pattern which does not interfere with the lift of the fixed wing. During hovering, however the downwash of the rotor is opposed by the fixed wing spread out beneath it and the effective lift of the machine is therefore 35 reduced. It is an object of the present invention to provide means whereby this disadvantage of fixed lifting wings is reduced.

The invention provides a helicopter of the 40 above kind having a supporting rotor and fixed wings which provide positive lift in forward flight characterised by the feature that the wing, or at least an outboard portion of the wing, at each side of the machine, may be turned about an axis extending in the fore and aft direction of the machine into 45

a substantially vertical position during hovering whereby negative lift produced by downwash from the rotor on the wing may be reduced or eliminated.

In one form of the machine the wing or wing portion is turned downwardly and carries at or near its extremity a landing wheel, (or wheels), the length of the wing or portion which is turned down being such that the wheel is then in a suitable position to support the machine during landing. Means may be provided for retracting the wheel into, or substantially into, the wing when raised.

As an example of the invention one specific form of helicopter embodying the above and other features will now be described with reference to the accompanying drawings, in which :—

Figure 1 is a side view of the machine 65 with the wing portion shown raised in full lines and lowered in chain lines;

Figure 2 is a plan view of the machine showing the wing portions raised; and

Figure 3 is a front view of the machine 70 showing the wing portion in its raised position in full lines and in the lowered positions in chain lines.

The helicopter forming the subject of this example has a single rotor, indicated at 10, employed both for supporting and propelling the machine, the rotor being driven by gaseous jets emitted from the rotor blades. At a position beneath the rotor the machine has a pair of short fixed lifting wings 11. 75 Each of these wings is constructed in two parts 11a, 11b which are hinged together about a horizontal fore and aft axis 12 about one-quarter of the length of the wing from the body of the machine. The wings are positioned somewhat above the longitudinal axis of the body. The outer portions 11b of the wings are movable downwardly into a vertical attitude (as shown in chain lines in Figures 1 and 3) and each carries at 80 85 90

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its extremity a landing wheel 14. A hydraulic retracting and shock absorbing means as described in our Specification No. 5053/53 (Serial No. 743,857), is provided in each wing for raising or lowering the outer portion 11b of the wing, for extending and retracting the wheel 14 and for absorbing landing shocks. The wheel lies in the plane of the wing and when retracted is enclosed by a suitable fairing (not shown) which automatically moves into place in manner known per se. The wing tip form is thereby recovered and its aerodynamic features retained.

15 Among the advantages of the construction above described are that it provides a simple form of landing mechanism, that it reduces loss of effective lift during hovering and that the lift on the hinged portions 11b of the wings derived from forward flight may be employed to assist in raising these portions.

What we claim is:—

1. A helicopter of the kind described having a supporting rotor and fixed wings which provide positive lift in forward flight characterised by the feature that the wing, or at least an outboard portion of the wing, at each side of the machine, may be turned

about an axis extending in the fore and aft direction of the machine into a substantially vertical position during hovering whereby negative lift produced by downwash from the rotor on the wing may be reduced or eliminated.

2. A helicopter as claimed in Claim 1 in which the wing or wing portion is moved downwardly.

3. A helicopter as claimed in Claim 2 in which the wing or wing portion carries at or near its extremity a landing wheel (or wheels), the length of the wing or portion which is turned down being such that the wheel is then in a suitable position to support the machine during landing.

4. A helicopter as claimed in Claim 3 in which means are provided for retracting the wheel into, or substantially into, the wing when raised.

5. A helicopter constructed and arranged for operation substantially as described and shown in the accompanying drawings.

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London, E.C.1,
Chartered Patent Agents.

PROVISIONAL SPECIFICATION.

Improvements in Helicopters.

We, PERCIVAL AIRCRAFT LIMITED, a British Company, of Luton Airport, Bedfordshire, and LESLIE GEORGE FRISE, a British Subject, of the Company's address, do hereby declare this invention to be described in the following statement:—

The invention relates to helicopters of the kind which are both supported and propelled by rotating wings. In such machines a limitation in the forward speed is reached at the onset of compressibility effects at the tips of the blades as they advance and of tip stall of the blades as they retreat. Reduction in the rate of rotation of the rotor reduces the limitation until the variation in lift of the advancing and retreating blades causes excessive flapping with resultant vibratory and other troubles. The provision of fixed wings on such aircraft which have the effect of reducing the load on the rotor in forward flight is effective in reducing these objectionable conditions and enabling still higher forward speeds to be obtained.

75 The flow of air through the rotor of such machines during forward flight follows a pattern which does not interfere with the lift of the fixed wing. During hovering, however, the downwash of the rotor is opposed by the fixed wing spread out beneath it and the effective lift of the machine is therefore

reduced. It is an object of the present invention to provide means whereby this disadvantage of fixed lifting wings is reduced.

The invention provides a helicopter having a supporting rotor and fixed wings which provide positive lift in forward flight characterised by the feature that the wing, or at least an outboard portion of the wing, at each side of the machine, may be turned into a substantially vertical position during hovering whereby negative lift produced by downwash from the rotor on the wing may be reduced or eliminated.

In the preferred form of the invention the wing or wing portion aforesaid may be turned about an axis extending in the fore and aft direction of the machine and it is further preferred that the wing is moved downwardly.

In one form of the machine the wing or wing portion is turned downwardly and carries at or near its extremity a landing wheel (or wheels), the length of the wing or portion which is turned down being such that the wheel is then in a suitable position to support the machine during landing. Means may be provided for retracting the wheel into, or substantially into, the wing when raised.

As an example of the invention one speci-

fic form of helicopter embodying the above and other features will now be described.

The helicopter forming the subject of this example has a single rotor employed both for supporting and propelling the machine, the rotor being driven by gaseous jets emitted from the rotor blades. At a position beneath the rotor the machine has a pair of short fixed lifting wings. Each of these wings is constructed in two parts which are hinged together about a horizontal fore and aft axis about one-quarter of the length of the wing from the body of the machine. The wings are positioned somewhat above the longitudinal axis of the body. The outer portions of the wings are movable downwardly into a vertical attitude and each carries at its extremity a landing wheel. A hydraulic retracting and shock absorbing means as described in our Provisional Specification No. 5053/53 (Serial No. 743,857) is

provided in each wing for lowering the wing, for extending and retracting the wheel and for absorbing landing shocks. The wheel lies in the plane of the wing and when retracted is enclosed by suitable fairing which automatically moves into place. The wing tip form is thereby recovered and its aerodynamic features retained.

Among the advantages of the construction above described are that it provides a simple form of landing mechanism, that it reduces loss of effective lift during hovering and that the lift on the hinged portions of the wings derived from forward flight may be employed to assist in raising these portions.

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Fig. 1.

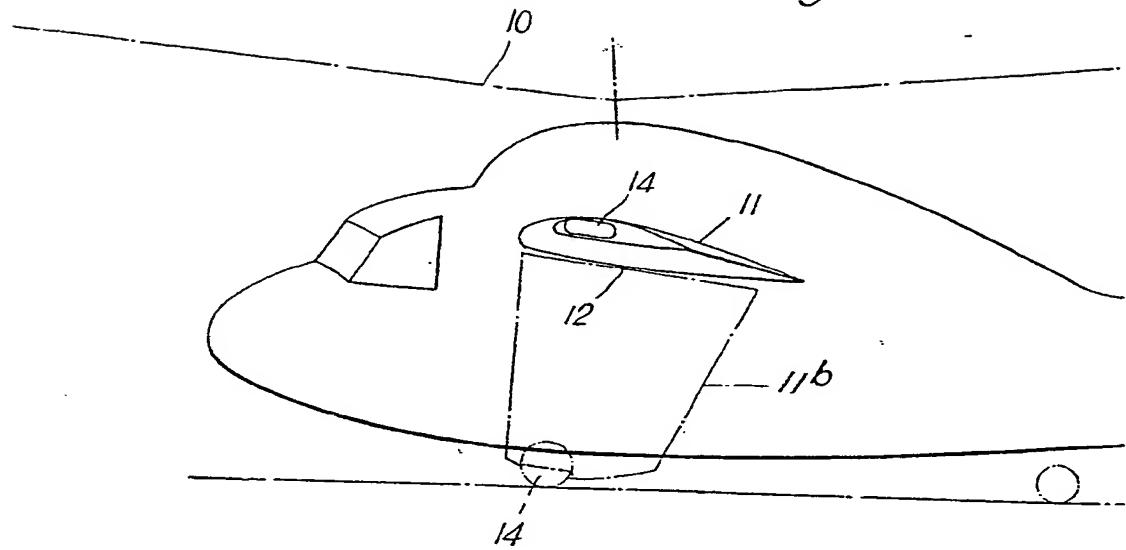
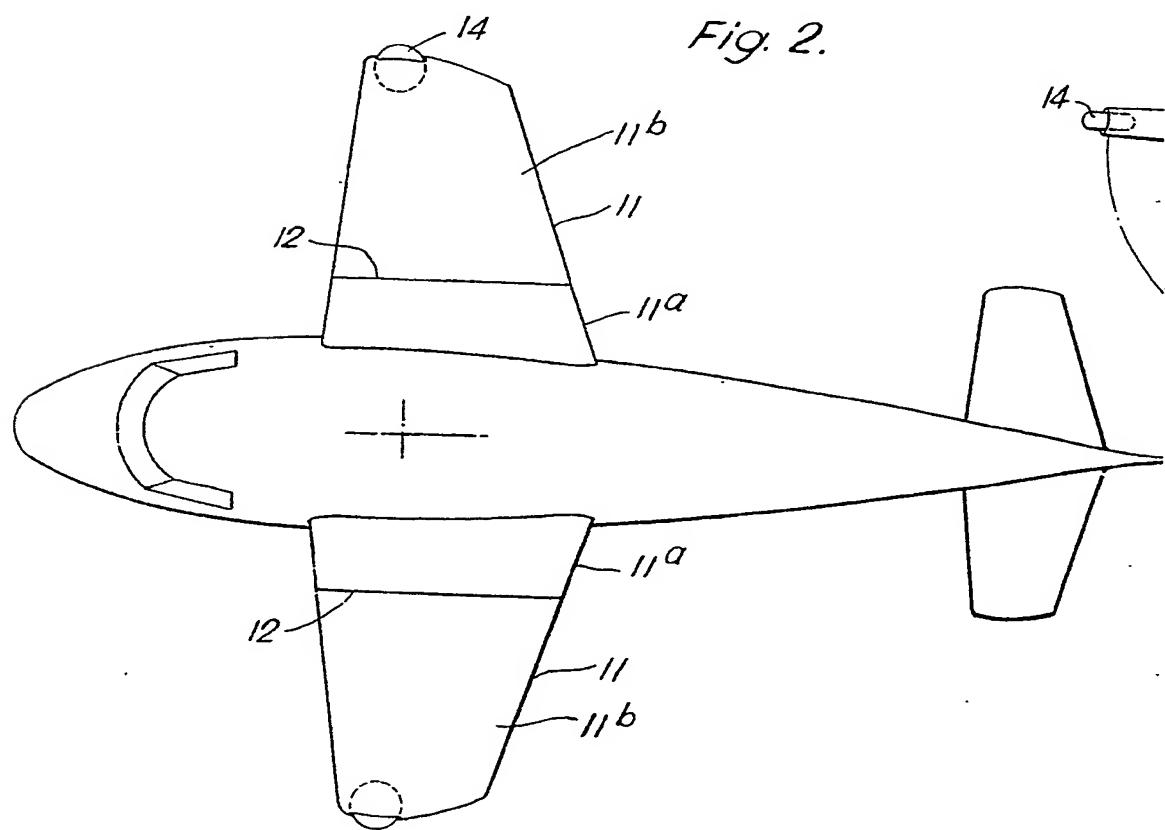


Fig. 2.



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the Original on a reduced scale.*

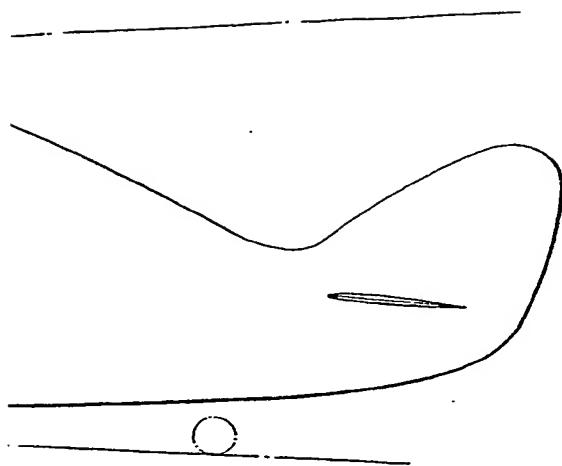
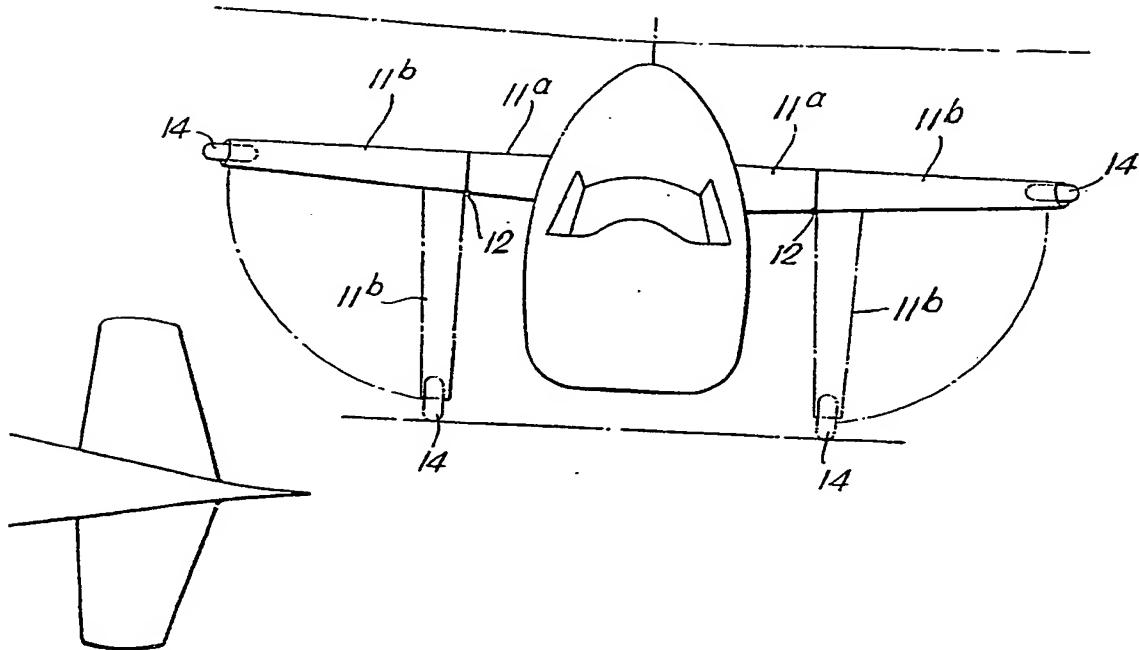


Fig. 3.



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Fig. 1.

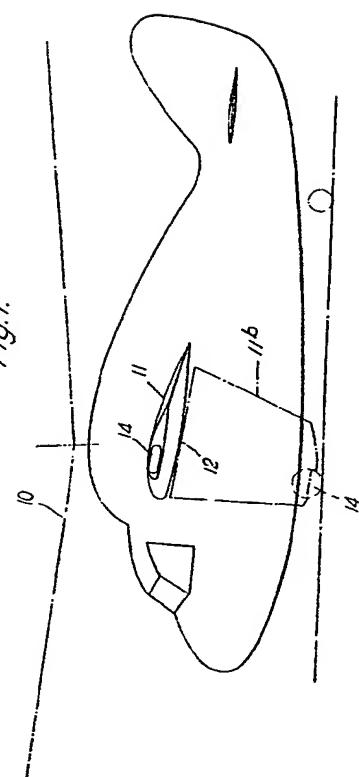


Fig. 3.

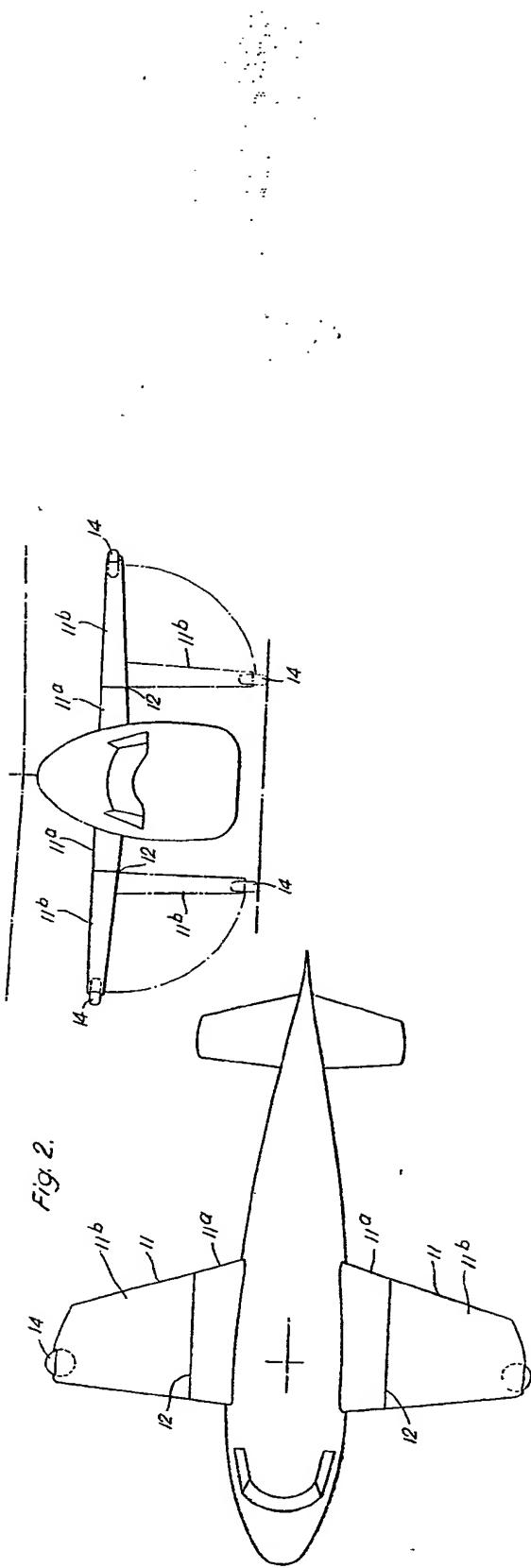


Fig. 2.